REMARKS

Initially, Applicants acknowledge the election and prosecution of claims 8-9 and 11-19 in the application. However, claims 1-3, 6, 21-22, 24-26, 29-33, 36-37, 39-46, 49-57, 61,65, 68, and 71-76 have remained withdrawn, and not been cancelled, due to the possibility of rejoinder, should claims 8-9 and 11-19 be allowed.

Turning to the prior art rejections, the Examiner has rejected claims 8-9 and 11-18 under 35 U.S.C. 103(a) as being obvious and, therefore, unpatentable over Wrighton et al. U.S. Patent No. 5,223,117 (hereinafter "Wrighton"). According to the Examiner, the only difference between Wrighton and the claims is a recitation of relative dimensions of the claimed device. However, the Examiner asserts that a device having the claimed dimensions would not perform differently than the prior art device and therefore, the claimed device is not patentably distinct from the prior art device.

Applicants have reviewed the Office Action and the prior art and disagree that one of ordinary skill in the art would predictably use carbon modified with a chemically sensitive redox active material in a working electrode of a pH sensor, with any reasonably expectation of success, as required by the present claims from a fair reading of Wrighton. Wrighton makes several observations that must be considered by one of ordinary skill in the art when using Wrighton as a reference. First, Wrighton states that the redox reagents (on the working electrode) must be durably surface confinable (Column 4, lines 57-58). Wrighton also states that two examples of such redox reagents include: (a) spontaneously self-assembling molecules (Column 4, lines 59-68), which are indicated to be preferred (Column 4, lines 65-68); and (b) electrodeposited redox agents (Column 5, line 1).

Second, Wrighton states that, in a preferred embodiment, the redox reagents are applied to "electrically conductive microelectrodes having good stability and the ability to be functionalized, such as platinum, gold, silver, palladium, and combinations thereof" (Column 5, lines 19-23). Wrighton further states that "[P]latinum and gold are optimal materials" (Column 5, line 35), and only gold microelectrodes are used in the Examples of Wrighton (Column 6, line 48 to Column 12). The principal focus is on the use of the self-assembly of thiol reagents on the electrode surface (Column 6, lines 5-27; and Examples 1 to 4). In fact, the only mention of carbon is a list of possible materials recited in claim 6 (Column 14, line 13). Upon a fair reading of Wrighton, there is no disclosure of the use of carbon for the working electrode. In actuality, the only description of carbon is for the counterelectrode (Colum 4, line 2).

Thus, it is clear that Wrighton has no intention to use, and provides not motivation to use, carbon in the working electrode. It appears that Wrighton simply made a clerical error in including carbon in the list in claim 6 (Column 14), and there was no suggestion or motivation to provide carbon in that electrode based upon the complete disclosure of Wrighton. One of ordinary skill in the art would not have expected or been motivated to include carbon in the working electrode based on Wrighton, only in the counter electrode. A clerical error made in a claim that is unsupported by its disclosure and description in the patent should not be considered as suggesting what is novel to the present inventors in every respect. One of ordinary skill in the art would have understood carbon to be different from gold and platinum, based upon the skilled artisan's common knowledge of the art, and would not have expected any success in using carbon for the working electrode.

Again, and in light of the above observations, the only suggestion of Wrighton is to use working electrode substrates such as gold and platinum, but not carbon. For example, in Example 1 of Wrighton, the self assembly of ferrocenyl thiol and quinone thiol onto gold microelectrodes is described. However, the surface chemistry of gold and platinum is very different to that of carbon, both in terms of quantitative and qualitative behaviour. Furthermore, the use of thiol reagents to modify carbon would not provide a spontaneously self-assembling monolayer as it would on a gold or platinum electrode. It is well known that self-assembled monolayers (SAMs) of thiols occur spontaneously when a platinum or gold metal is simply dipped in a solution of the thiol species, and there is a wealth of literature devoted to such SAMs and their formation. The energetics of the gold-S or platinum-S bond formation is sufficient to drive this process. This is because these metals have large (diffuse) d-orbitals and some empty low-lying orbitals for bond formation with the donor sulphur ligand. Carbon has neither of these and usually has a full valence electron shell in materials such as graphitic carbon, so it is unable to spontaneously form a C-S bond, for which the C-S bond energy is insufficient to drive the process spontaneously. It is a well-known chemical fact that SAMs do not form on carbon through simple thermodynamic considerations. Thus, substitution of carbon for the gold or platinum used in the Examples will not suffice. One of ordinary skill in the art would know this, and could not reach a conclusion that substitution of carbon for the gold or platinum based upon the teaching of Wrighton would meet with any reasonable expectation of success.

In support of this, one of the named inventors of the present application, Dr. Gregory Wildgoose, has submitted his declaration pursuant to 37 CFR 1.132, indicating the same. In fact, Dr. Wildgoose

submits that given that one of ordinary skill in the art would have knowledge of the above and would appreciate that the surface chemistry of carbon is different from that of gold and platinum, one of ordinary skill in the art could not, on the basis of Wrighton, have predicted the use of carbon as an electrode with any reasonable expectation of success. Thus, he avers that it would not be obvious to one of ordinary skill in the art at the time the invention was made, and based on the teaching of Wrighton, to contemplate a pH sensor comprising a carbon working electrodes modified with a redox active species.

Dr. Wildgoose further indicates that the use of a pH sensor comprising a working electrode comprising carbon modified with a chemically sensitive redox active material, as required by claim 8 of the present application, also provides additional advantages that are not taught by Wrighton. For instance, the thiol chemistry described in Wrighton will be especially sensitive to oxidation or reduction either by chemical species in the solution or by the direct effect of the applied electrode potential. These films may therefore show limited stability in many environments. In contrast, a carbon working electrode that is modified with a redox active species offers quantifiably improved stability and inertness under a wider range of conditions. Furthermore, carbon electrodes are significantly less expensive to produce enabling them to be used for applications in which gold or platinum electrodes would be too impractical and expensive. Still further, the surface modification of carbon affords greater control which renders them particularly suitable for mass production.

Applicants further note that claim 19 has been rejected as obvious and, therefore, unpatentable over Wrighton as applied above, and further in view of an article to Pandurangappa (hereinafter "Pandurangappa"). Although Applicants disagree with the Examiner, in order to maintain compact prosecution of this application, Applicants have elected, for the time being, to rely on the fact that they believe claim 8, from which claim 19 is dependent, is patentable and should be allowed.

In light of the foregoing and the attached Declaration of Dr. Wildgoose, Applicants respectfullyl request reconsideration of this rejection with a view toward allowance. A Notice of Allowance of at least claims 8-9 and 11-19 is earnestly solicited. Should the Examiner wish to discuss any of the foregoing in more detail, the undersigned attorney would welcome a telephone call.

Respectfully submitted,

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